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Major Facilities of the NUSC Launcher and Missile Systems Department

Naval Underwater Systems Center
Newport, Rhode Island • New London, Connecticut

Naval Underwater Systems Center
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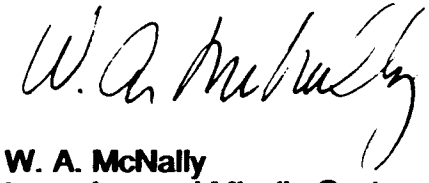

W. A. McNally
Launcher and Missile Systems Department

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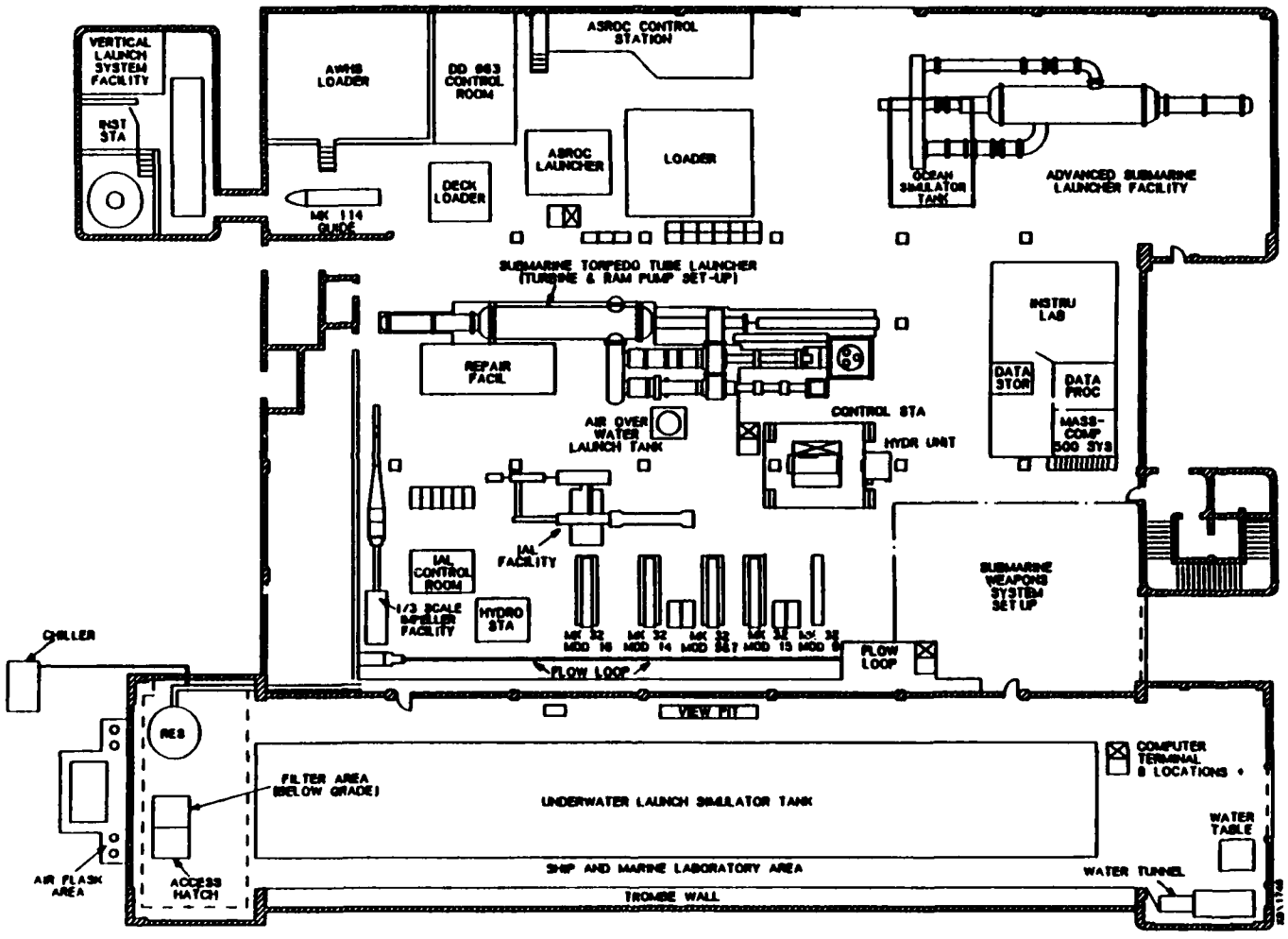
MAJOR FACILITIES OF THE NUSC LAUNCHER AND MISSILE SYSTEMS DEPARTMENT

INTRODUCTION

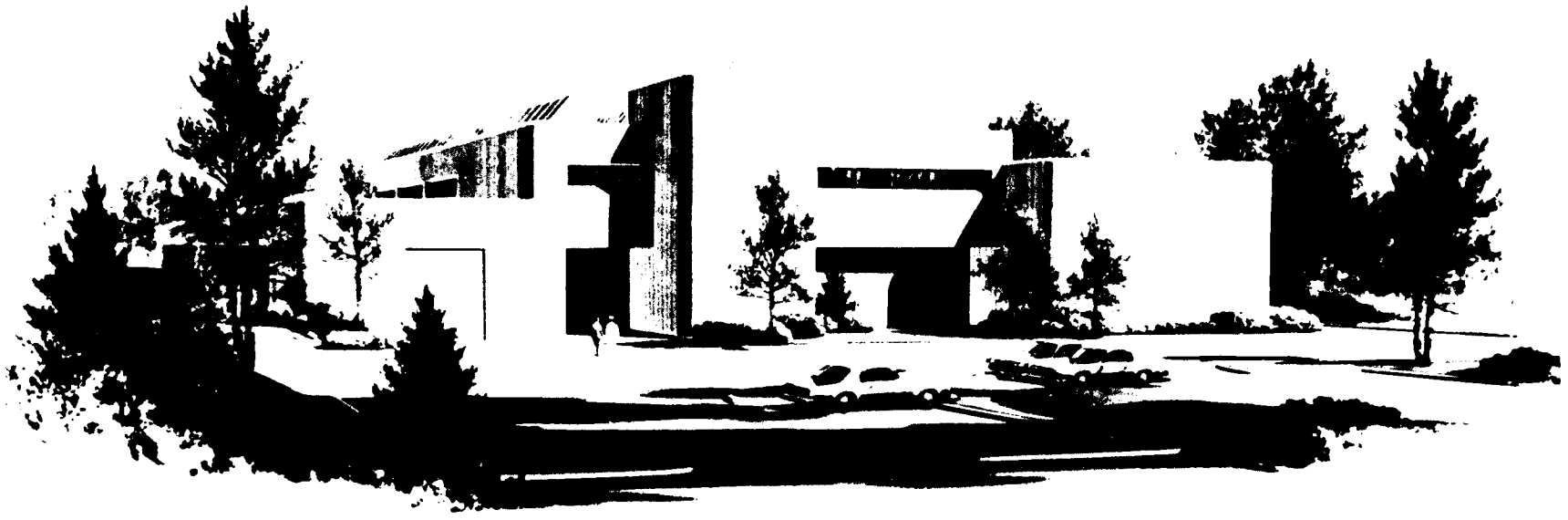
This document describes the facilities of the Naval Underwater Systems Center (NUSC) in the area of submarine and surface ship launchers and submarine-launched missile systems.

The principal responsibility of the Center's Launcher and Missile Systems Department is to provide technical leadership for submarine and surface ship antisubmarine warfare weapon launch and handling systems and submarine-launched tactical missiles. Efforts include research, development, testing, and in-service engineering for submarine torpedo tubes, surface ship launchers, and submarine-launched tactical missiles. As part of this broad responsibility, the department oversees many facilities to support evaluation of launcher and missile performance. The facilities are housed in five buildings located around the Newport Laboratory, with the majority of facilities found in Building 1246.

BUILDING 1246

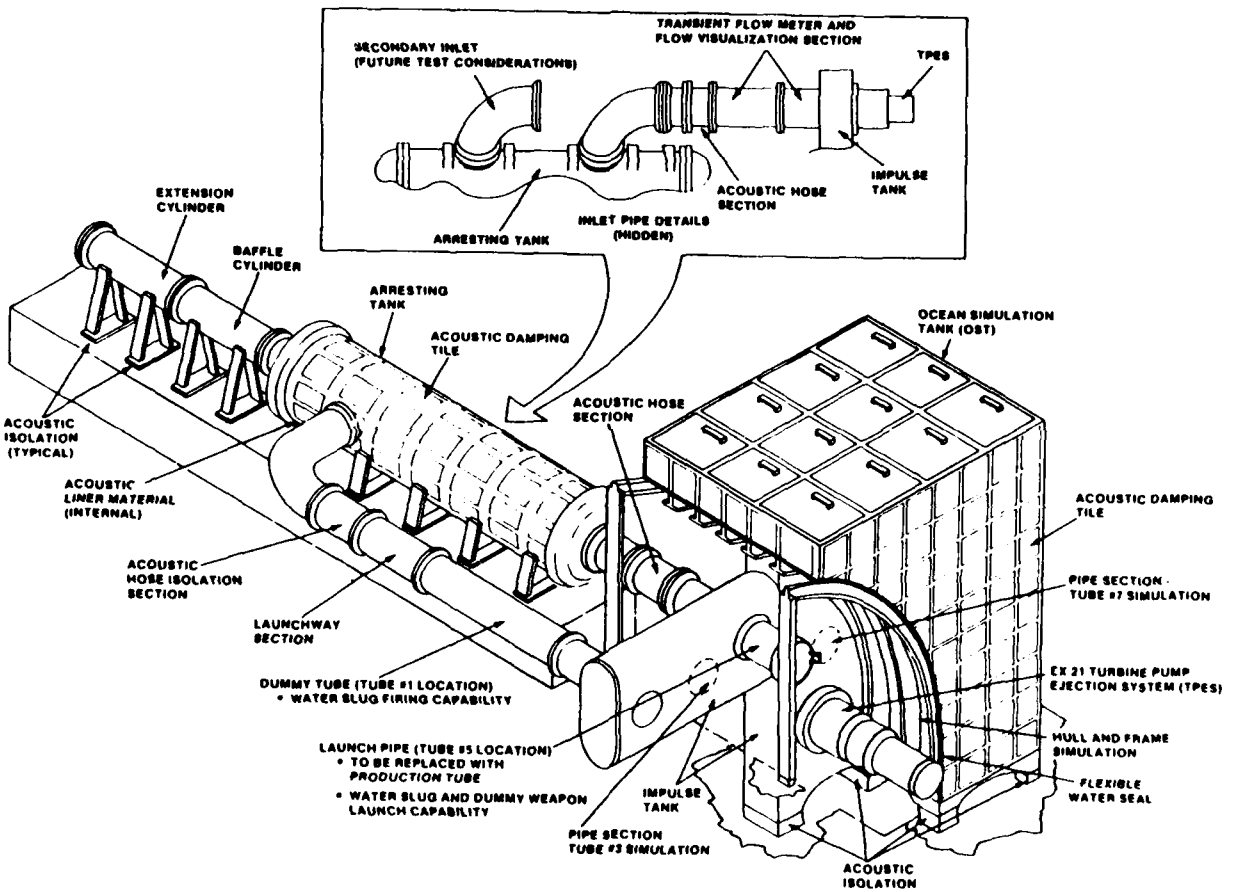


Building 1246 Floor Plan

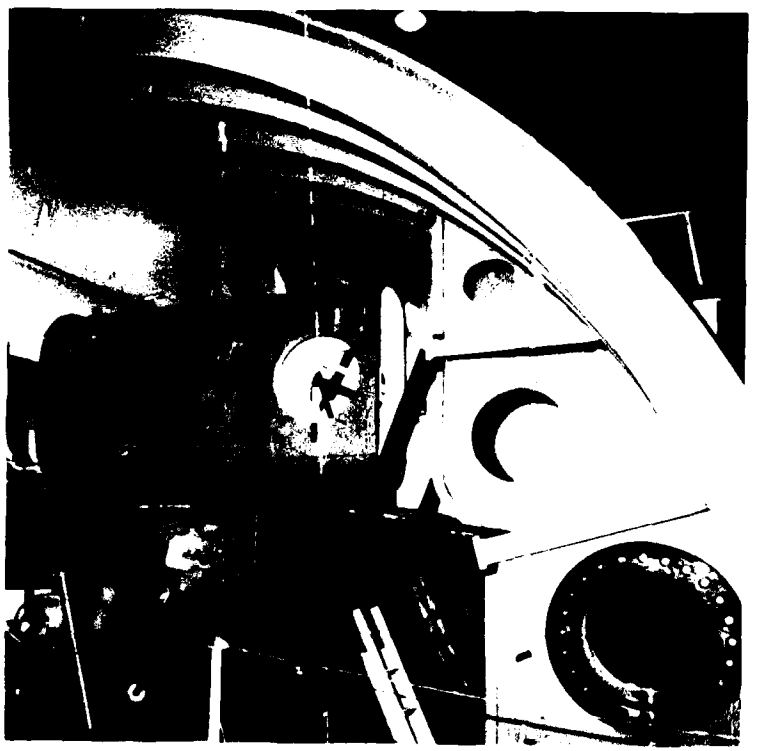


The Launcher and Missile Systems Department facilities are primarily housed in Building 1246, one of the newest buildings at NUSC. This building also houses many of the department's personnel. At present, there are seven major facilities in or attached to the building that are fully operational. Two other facilities will be operational by the end of 1990, and another is in the planning stage. Complete computer facilities are also housed in the building to aid engineers and scientists in their RDT&E work.

ADVANCED SUBMARINE LAUNCHER FACILITY



This multipurpose evaluation facility is scheduled to be completed by July 1990. It will have the capability to evaluate advanced launcher systems; to test large-diameter, weapon vehicle component upgrades; and to test and evaluate upgrade programs for the SSN 21 (SEAWOLF) class submarine. In addition, the facility is capable of testing the Mk 19 turbine pump ejection system (TPES). The facility components support the test and operation of the launch system in a land-based laboratory. The first systems to be tested and evaluated will be the new prototype EX 21 air turbine pump (ATP) and lead ship ATP systems. Testing of the Mk 19 TPES will follow; the TPES test data will be compared with at-sea data at that time. The production SEAWOLF-class torpedo tube and the hydraulic control system will be tested at a later date.



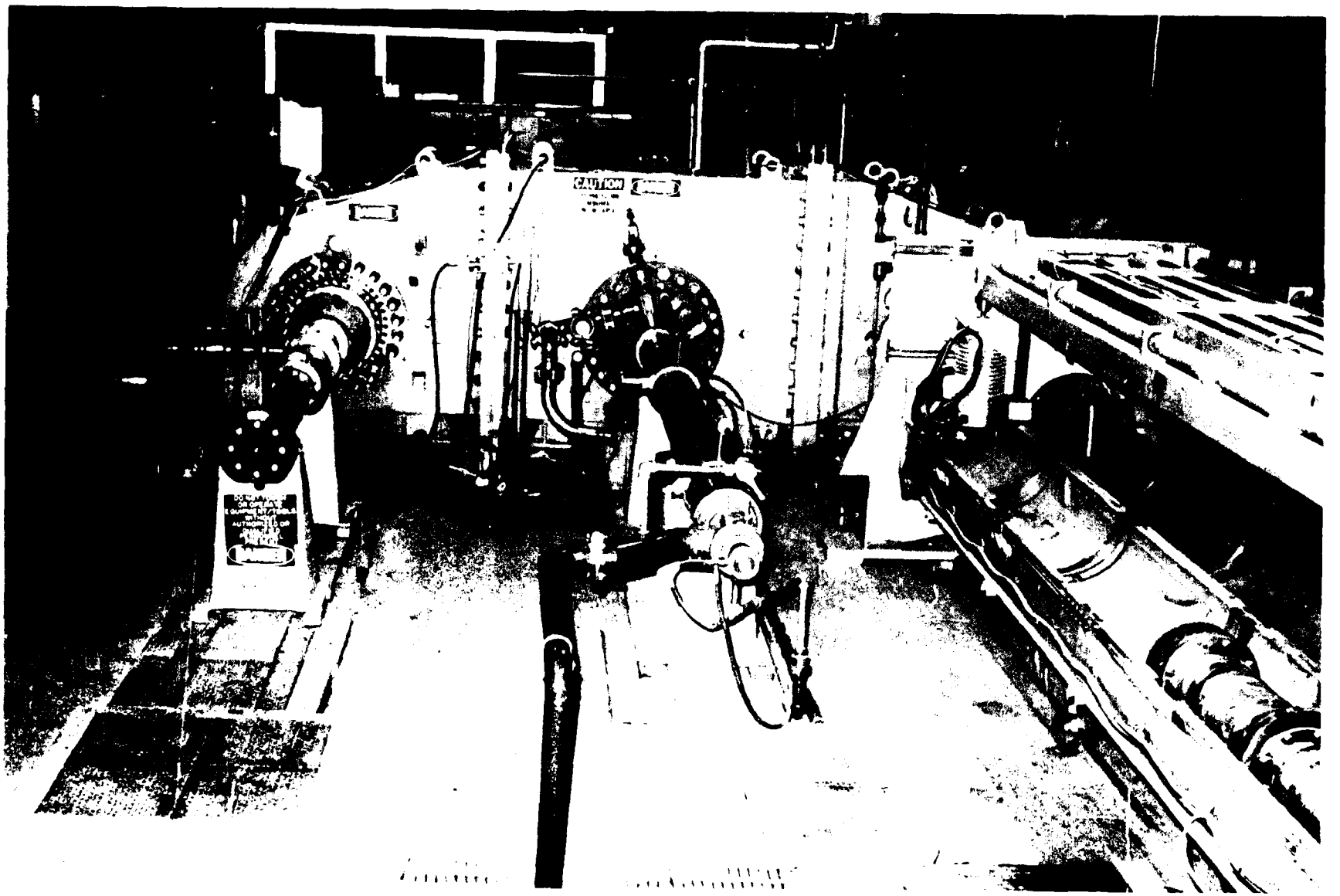
Impulse Tank with Hull and Frame Section

A main objective of this facility is to provide critical information concerning the functional and acoustic performance of the SSN 21 launch system before hardware is required for the lead ship. The torpedo tube control panel of the new system will be tested to a lesser extent in the facility, because only display and control components related to the production torpedo tube are included.

The facility will provide launch system tests to SSN 21 full-depth pressure, launch system tests using a dummy weapon (torpedo tube no. 5), adaptability to future large-diameter weapon testing, water slug firing from the upper tube (torpedo tube no. 1), simulation of actual shipboard launch system water masses and flow losses, and simulation of an actual shipboard impulse tank, including hull and frame section. It also features acoustically isolated foundations and an ocean simulation tank for radiated-noise measurements.

Initially, a launch pipe (torpedo tube no. 5 location) will be installed in the facility. After EX 21 prototype and lead ship ATP production unit tests are completed, present plans call for this launch pipe to be removed and a production SEAWOLF-class torpedo tube with a quiet valve and tube control system to be installed.

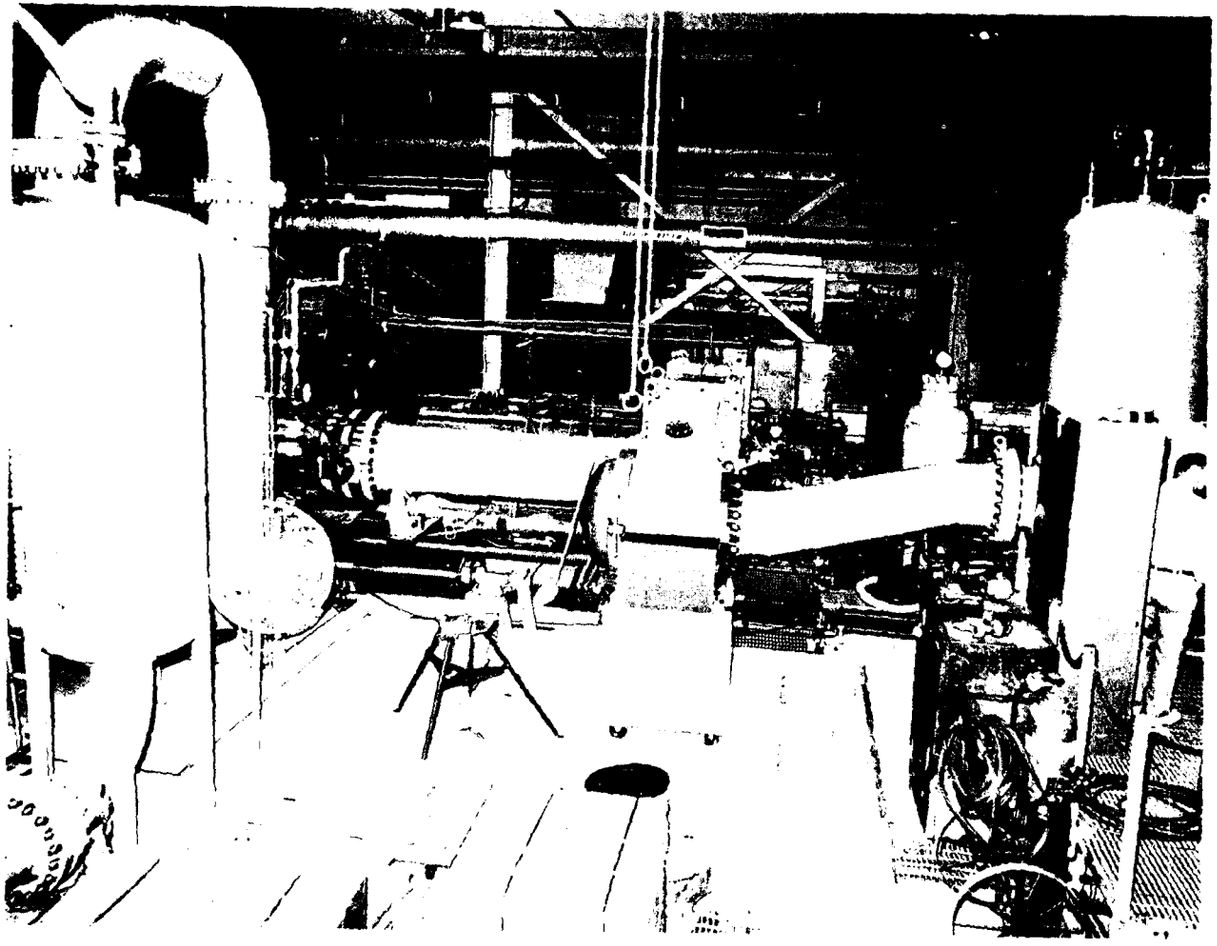
SUBMARINE LAUNCH SYSTEM TEST FACILITY



Submarine Launch System Test Facility Control Station

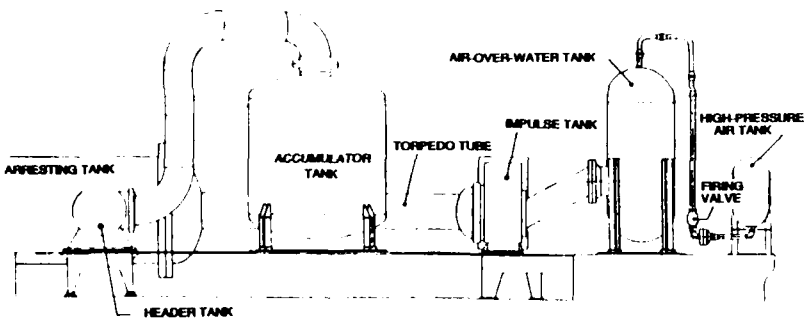
This facility has SSN 688/SSBN 726 equipment and equivalent capabilities, as well as dual-ejection systems and improved controls. Other features include a shipboard flood and drain system, a 4500-psi firing air system, and an advanced automated loading and handling system. The dual-ejection capability allows for concurrent, side-by-side firing comparisons of any two current or projected ejection systems including turbine pumps, ram pump, and air-over-water (A/W). Actual dummy torpedo firings and retrieval also are possible, which is a feature unique to this facility. All tests conducted are supported by a full range of state-of-the-art electronic instrumentation, measuring noise, vibration, pressures, speeds, timing, etc. In addition, data can be completely analyzed in-house on special equipment or computer assets.

AIR-OVER-WATER SUBMARINE TORPEDO EJECTION FACILITY



Front View of A/W Facility

The Air-Over-Water Facility has been designed to determine the overall performance (noise and launch dynamics) of the experimental A/W ejection system and to evaluate how this system compares with both the turbine pump ejection system (TPES) and the ram pump ejection system (RPES), which are currently in use in submarines.

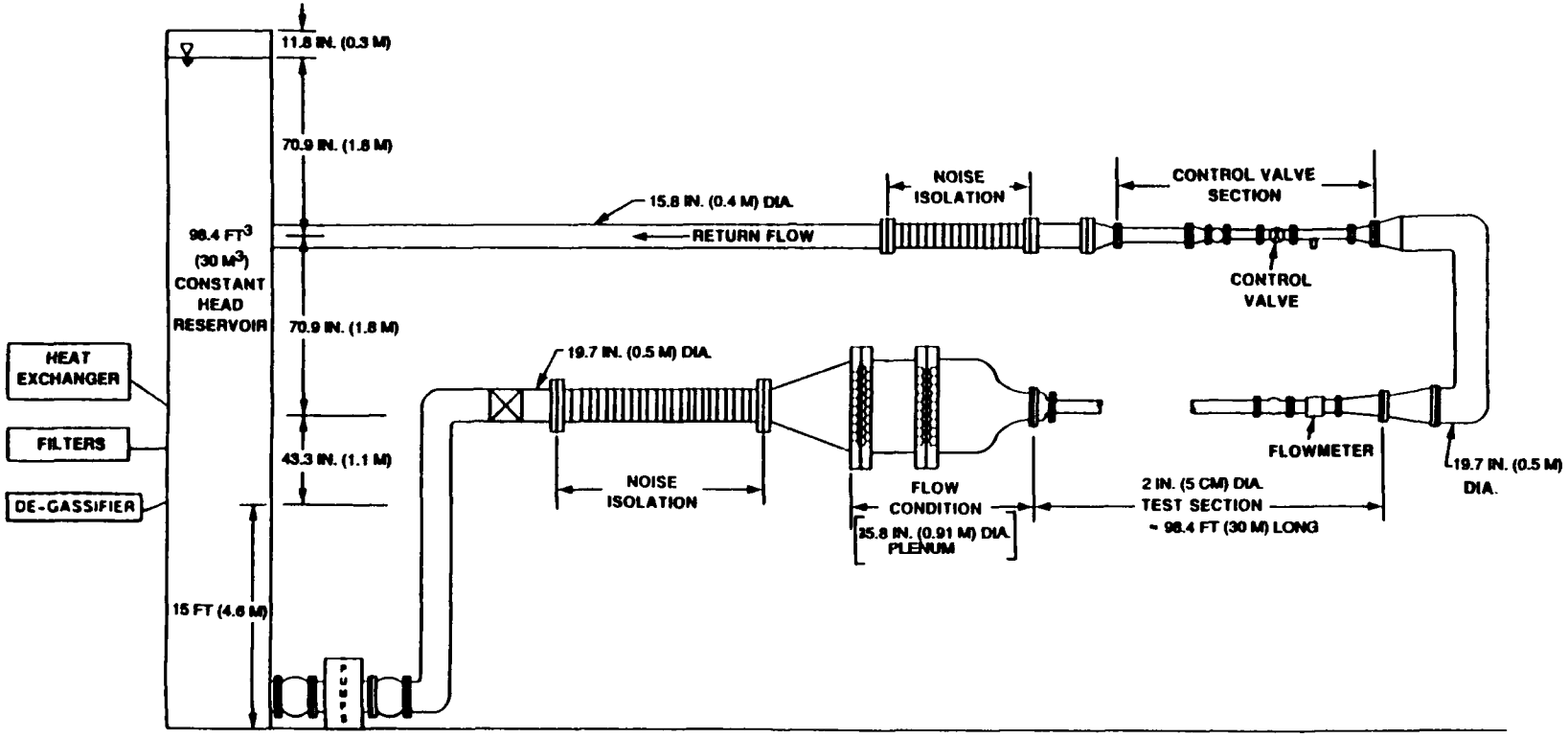


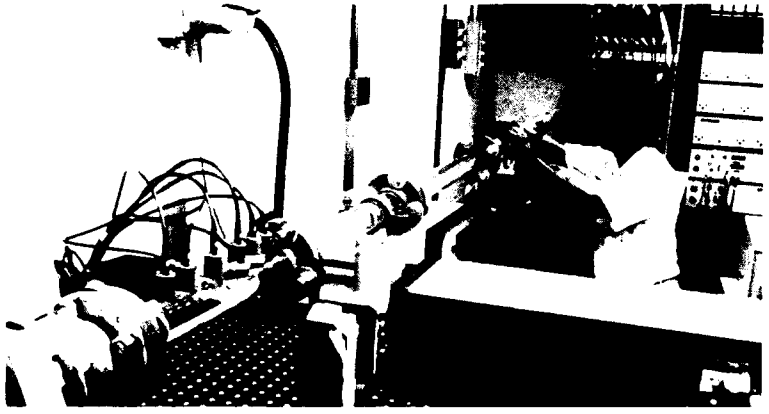
A/W Submarine Torpedo Ejection Facility

In this experimental facility, parameters such as number of high-pressure flasks, firing valve pressure, firing valve diameter, and various initial air volumes within the A/W tank can be varied to determine the effect on launch performance at various depths. Preliminary tests indicate that there is a significant reduction in radiated noise with the new A/W system as compared with either the RPES or the TPES, because all intermediate mechanical energy converters (piston, turbines, gear trains, etc.) have been eliminated. Energy is transferred from the air to the torpedo directly. Other advantages of A/W include controllable launch velocities, simplicity, and substantial cost savings.

Under this concept, high-pressure air is introduced into the A/W tank above the surface of the contained water. The water is forced through the A/W tank outlet into the impulse tank, which causes torpedo launch by pressurizing the rear of the torpedo. In the land-based test facility, the torpedo is captured by the receiving tank while the additional water introduced into the system is directed to the large accumulator tank that acts as the ocean environment.

FLOW LOOP FACILITY





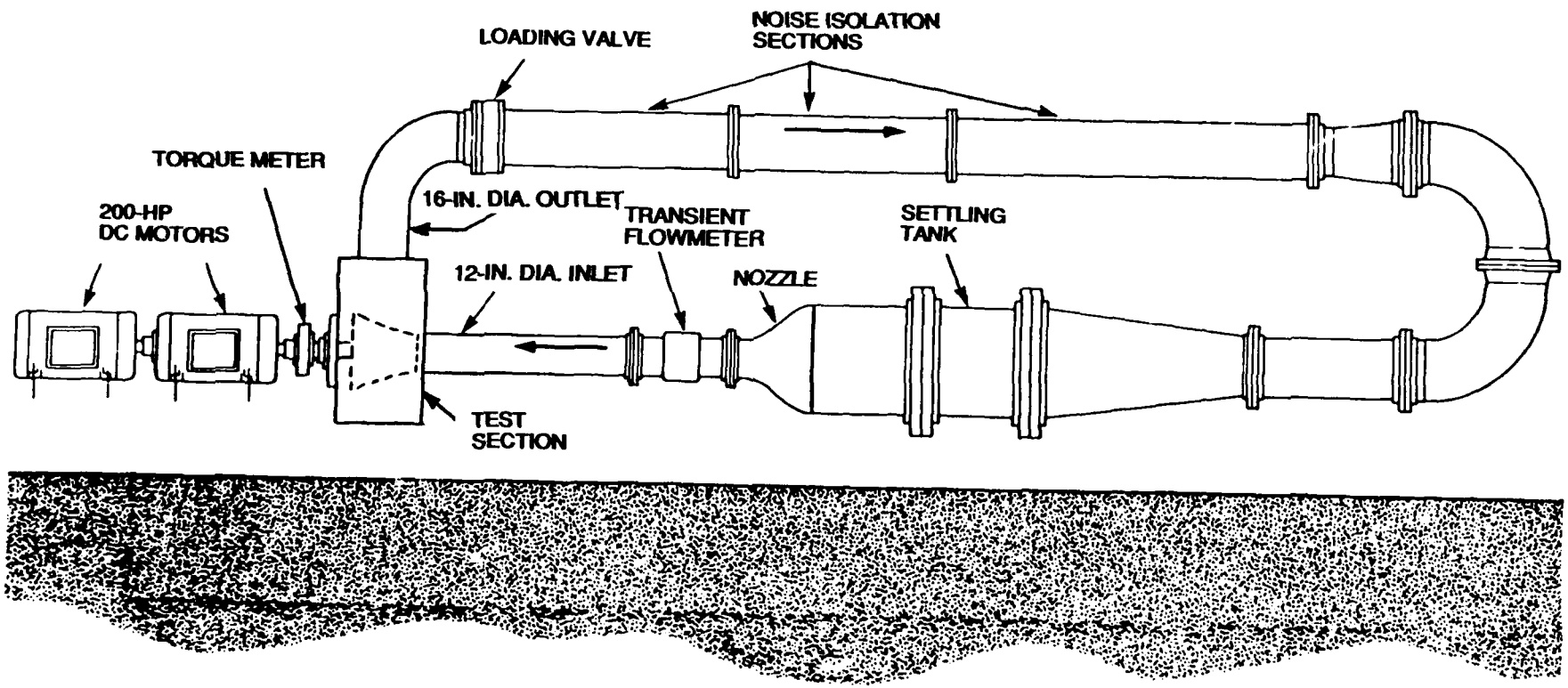
Flow Loop Facility During Testing

The Center's Flow Loop Facility provides unique transient hydrodynamic and hydroacoustic research capabilities unobtainable in any other known facility in the world. It allows for novel, unsteady flow experiments that will expand basic knowledge of accelerating flow physics and flow and hydroacoustic phenomena. This closed-loop facility has allowed development of previously unavailable transient flowmeter and new laser Doppler velocimeter techniques. The flowmeter provides the means of accurately measuring the instantaneous volumetric flow rate in the test section.

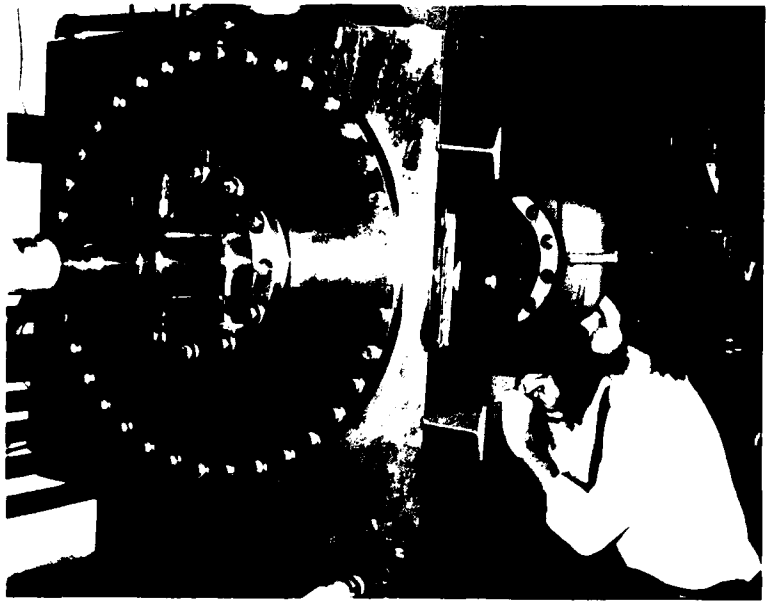
The facility supports a number of NUSC programs including high-speed weapon launch, IR/IED launch transient hydrodynamic projects, turbine pump design, and accelerating flow characterization.

In this facility, a controllable transient flow (accelerating), such as that observed in torpedo launch dynamics, can be obtained and evaluated. The facility can provide flow rates up to 12,000 gallons/minute in circular test sections up to 12 inches in diameter. With an unobstructed 100-foot-long test section, accelerating flows with velocities up to 40 feet/second (under constant accelerations) can be accommodated. Experimental accelerating flow parameters that can be investigated are noise generation, fluid velocity profiles, friction factors, transition Reynolds numbers, and acceleration head. A two-component laser Doppler anemometer system has been developed for the flow loop that can measure the instantaneous point velocity and turbulence even under the highly transient conditions provided by the facility. Also, instantaneous wall shear stress and wall pressure measurements are available at numerous hot-film and flush-mounted pressure transducer locations along the 100-foot-long test section. In addition, a unique transient flowmeter provides the means of accurately measuring the instantaneous volumetric flow rate in the test section.

ONE-THIRD-SCALE IMPELLER TEST FACILITY



The One-Third-Scale Impeller Test Facility is another facility unique to NUSC. Considered supplemental to the Flow Loop Facility, it provides steady-state and transient pump impeller operation. In addition, it allows for the research and development of weapon launch pump impellers that must perform with a minimum acoustic signature while in the transient mode of weapon ejection. No other Navy or private facility can measure system performance in the transient operating mode of the weapon launch system. Because the facility can operate under both transient and steady-state conditions, the effects of transients on pump performance and noise characteristics can be accurately evaluated. Details of the transient impeller flow field can be investigated using advanced flow-field visualization techniques in conjunction with the transient measurement techniques of the laser Doppler anemometer as developed for the Flow Loop Facility. This facility can evaluate quasi-steady impeller design methods, investigate the complex flow field of transient impeller operation and impeller cavitation, and identify impeller hydroacoustic noise sources.

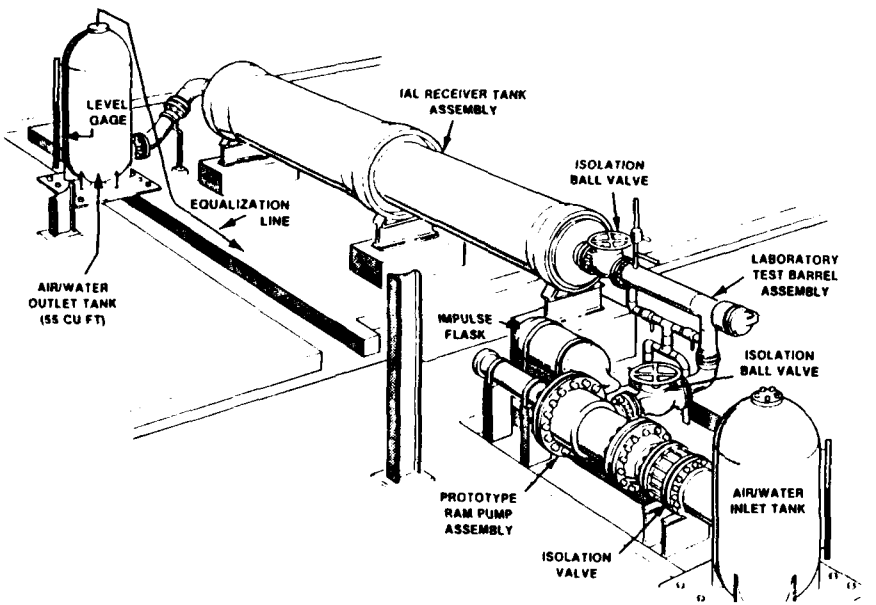


Observation of Cavitation in One-Third-Scale Facility

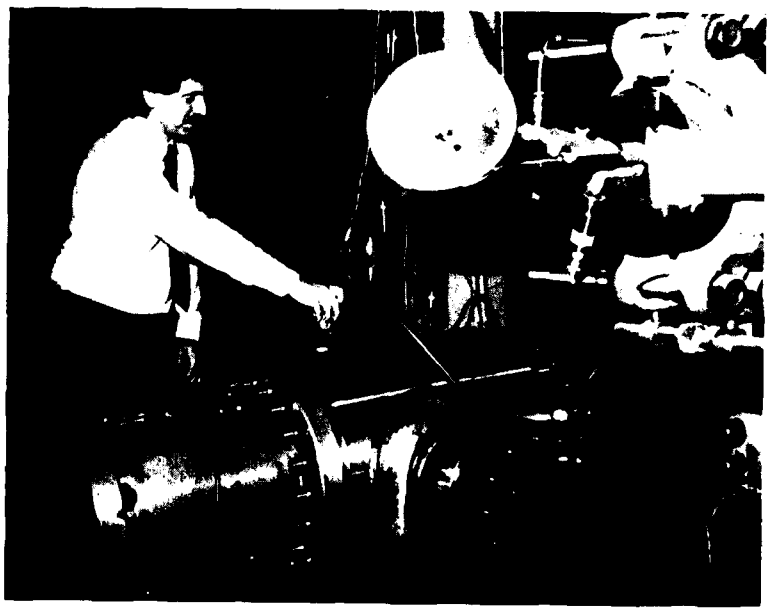
The impeller test facility supports the SSN 21 turbine pump impeller, advanced launch concepts ejection system impellers, and the turbine pump impeller optimization.

The computer-based motor control system, which provides the capability of user-defined impeller speed (rpm) versus time, is coupled to a computer-based control system that operates the loading valve according to user-defined transients. These coupled control systems provide an effective means of controlling the instantaneous impeller-developed head and speed and, consequently, flow rate. This allows for a close simulation of impeller operation under scaled submarine conditions.

INTERNAL AUXILIARY LAUNCHER FACILITY



IAL Facility



Vent Valve Adjustment for Ram Pump Water Cylinder

The Internal Auxiliary Launcher (IAL) Facility is used to test and evaluate a variety of ram pump configurations, and is capable of simulating and operating at depths in excess of the SSN 21 submarine (SEAWOLF class) test depth in a safe and effective manner. The facility accepts the launch of current 3-inch-diameter internal devices and, by design, the launch of any future internal 6-inch-diameter devices. Waterslugs can also be fired in this facility.

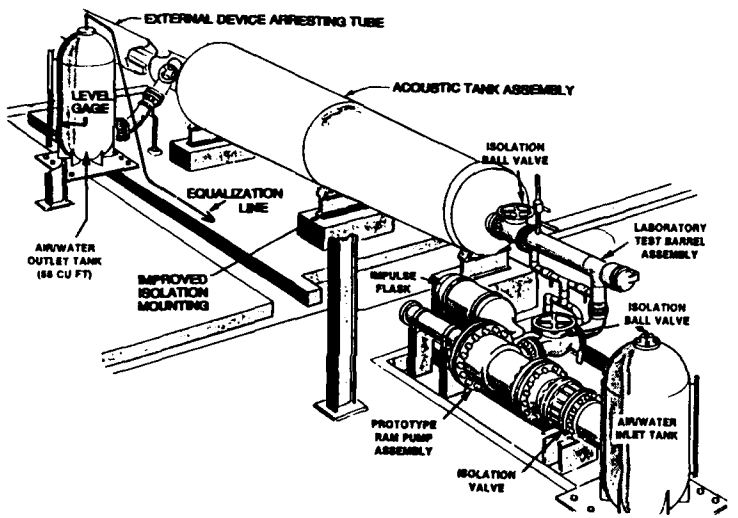
A unique small launcher facility has been proposed but has not yet been developed fully. Until it becomes a reality, the IAL facility is being upgraded to be used as the present small launcher facility. Upgrades include improved noise isolation mounting material and an improved pump mounting configuration (i.e., common pump and driver base plate). In FY 89, the facility was used to test and evaluate an experimental electromagnetic launcher system. The facility has been approved for launching of devices carrying class C explosives.

In this A/W-type facility, an equalization line connects the two 55-cubic-foot flasks: the inlet tank and the outlet tank. During a firing, the ram pump water cylinder water is taken from the inlet tank, accelerated, and pumped through the impulse pipe, test barrel, and receiver tank. An equal amount of water is displaced through the rear of the receiver tank and into the outlet tank. The equalization line keeps the inlet and the outlet tanks at an equal pressure.

An attempt has been made to acoustically isolate all the components in the IAL facility. The ram pump can be completely isolated from the rest of the facility, while the inlet and outlet of the pump can be isolated using a quiet flex-coupling. The couplings are designed to withstand a working pressure up to 250 psig.

The IAL facility is fully instrumented with accelerometers, pressure transducers, and receiver tank hydrophones. The temperature rise in the air cylinder is monitored by a thermocouple. The shaft speed is recorded by a linear displacement transducer. A magnetic flowmeter is located in the impulse pipeline. Vehicle velocity is monitored with both proximity sensors and the pressure velocity displacement assembly. All the data from the instrumentation are fed into the Building 1246 MASSCOMP data acquisition system.

SMALL DEVICE LAUNCHER AND SPECIAL PURPOSE TEST FACILITY

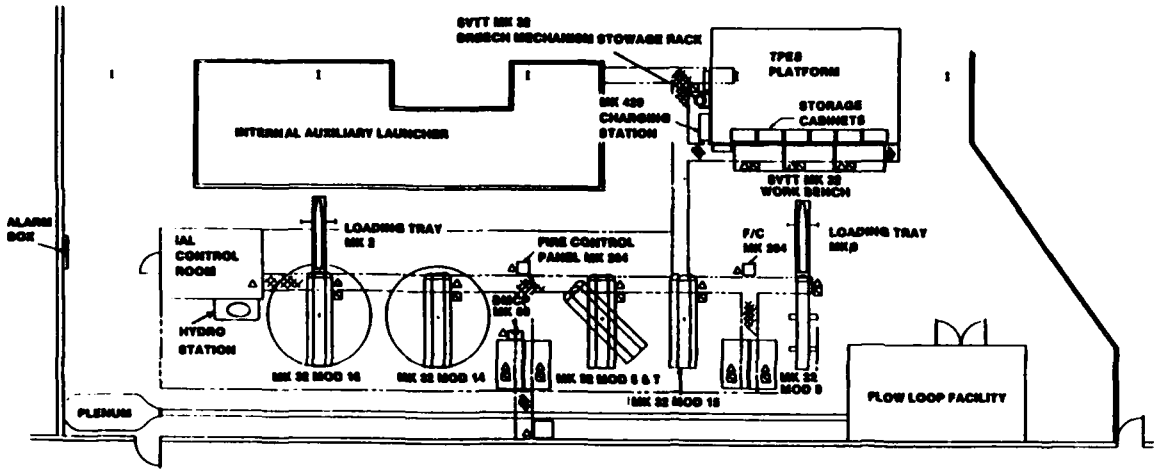


Proposed Small Device Launcher and Special Purpose Test Facility

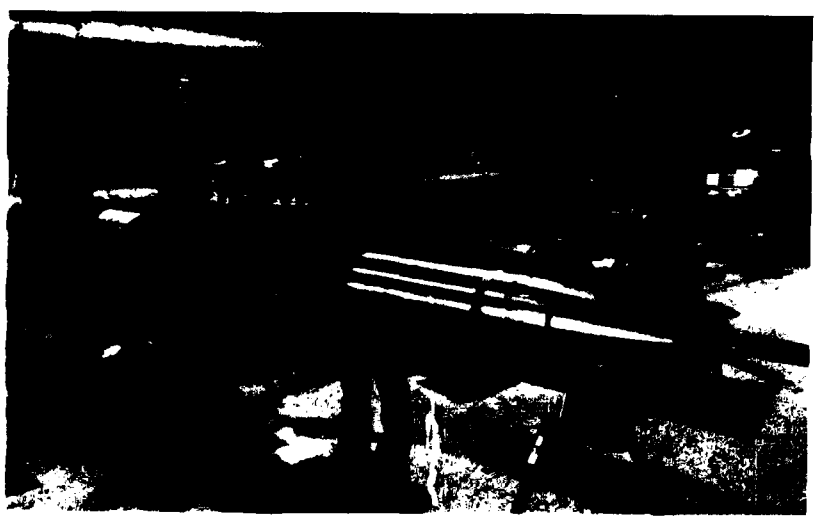
The Small Device Launcher and Special Purpose Test Facility, which is still in the planning stage, will be used to evaluate small device submarine launchers, both internal and external to the hull, and will have maximum collapse depth capability.

The facility is being developed to provide a land-based evaluation platform for the 3-inch and 6-inch internal and external launcher systems. This facility will be used to evaluate both the SSN 21 small device launch system (which is being developed at NUSC) and small external launchers, prior to fleet introduction. The facility differs from the IAL Facility in that it has a much greater pressure capability and its immediate use will be to evaluate a 6-inch launch system in lieu of a 3-inch system. It will provide the Navy with the means to evaluate the unique launch system being developed for the SSN 21 (SEAWOLF class) prior to installation in the ship. Once the prototype launch system is developed, this facility will be used to troubleshoot problems on this system.

SURFACE VESSEL TORPEDO TUBE FACILITY



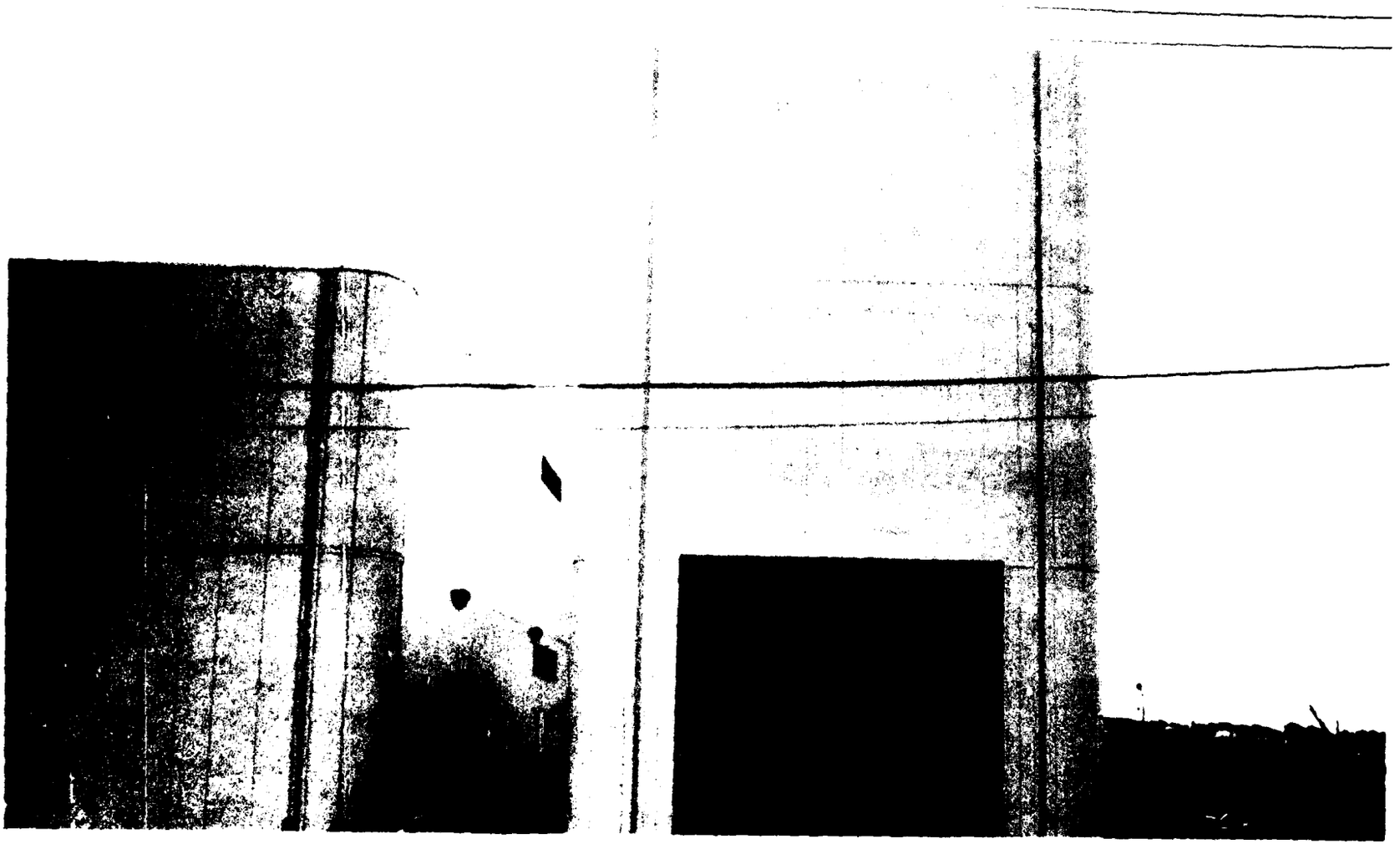
Surface Vessel Torpedo Tube Facility Floor Plan



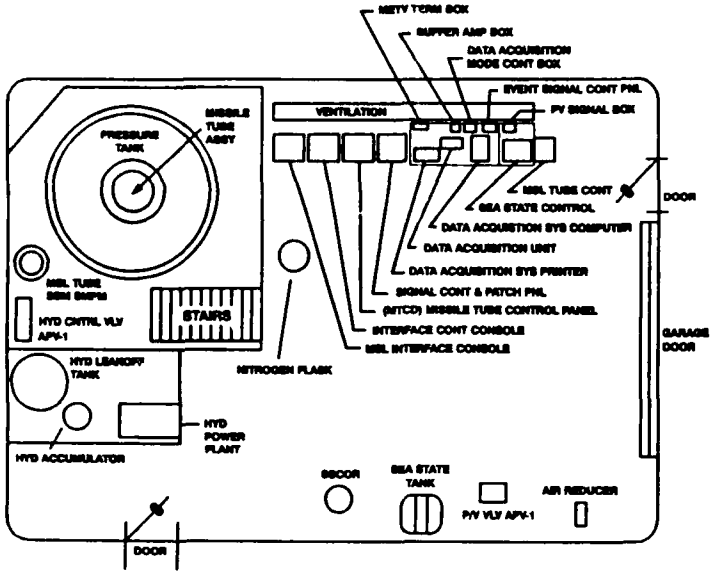
Preparing to Load Torpedo into Mk 32 Mod 9 Launcher

This facility continues to play a vital role in the development of new Mk 32 torpedo tube systems, including the Mod 15 for the DDG 51 class ships and the Mod 16, which will support the surface ship torpedo defense system to be employed on carriers and battleships. It is maintained to support assigned responsibilities including design agent and in-service engineering agent for surface ship torpedo tubes and associated equipments. All mods of active launchers and loading trays aboard surface combatants are located in this facility, which is used for new launcher development, ORDALT design/testing, and fleet problem troubleshooting. Electrical services, high-pressure and low-pressure air, and associated combat control panels are available. In addition, Air Charging Panel Mk 429 and tender workshop equipment are installed in duplicate fleet-issued equipment. Launchers are relocated periodically for dummy torpedo launching at the NUSC range facility, instrumented fleet firings, and actual torpedo trial launchings.

SSN 688 VERTICAL LAUNCH SYSTEM MISSILE TUBE TEST FACILITY



Newly Constructed PO 53 VLS Missile Tube Facility Outside Building 1246



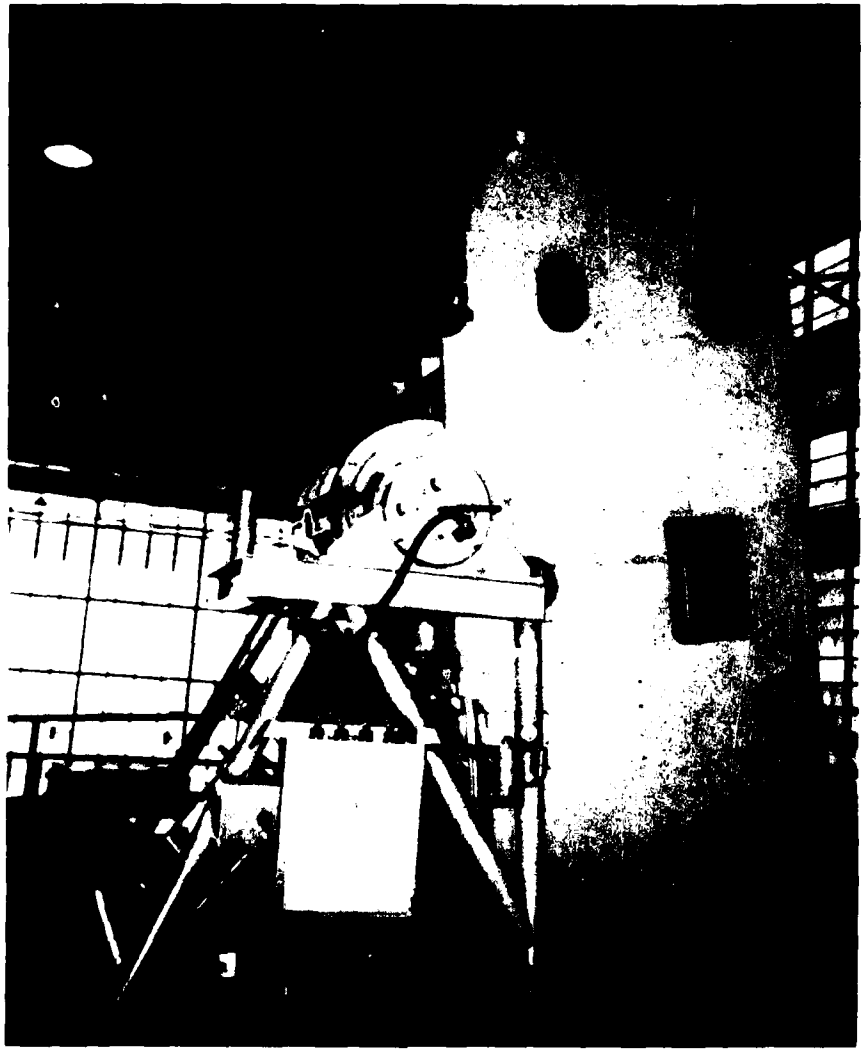
VLS Facility Floor Plan

Control Station for VLS Test Facility

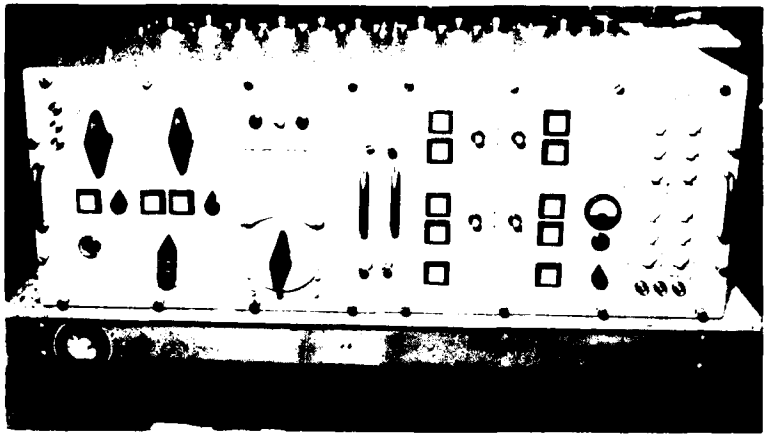
Designed as a multipurpose facility, the SSN 688 Vertical Launch System (VLS) Missile Tube Test Facility will be operational in December 1990. This facility will be housed in a separate building attached to Building 1246. The main purpose of the facility is to test the design and operation of ocean-exposed components of the SSN 688 VLS missile tube under the effects of depth pressure, by duplicating actual fleet system operating conditions. Presently, this function can be performed only at sea on VLS-equipped SSN 688-class submarines. The facility will also accommodate and evaluate current and planned missile tube payloads, including ballast cans, and capsule launching systems (Tomahawk antiship missile and Tomahawk land-attack missile) under environmental operating conditions. In addition, it will be able to duplicate actual VLS loading and handling operations as they occur on SSN 688 VLS-equipped submarines.

A fully operational VLS missile tube, including hydraulic, pressure/vent, and flood/drain subsystems will be part of the facility. The missile tube hatch and attached hull fairing section, along with all sea-exposed components, will be housed in the lower section of a split-sectioned, ASME-certified, pressure test tank. Vertical launch center control consoles, as equipped on SSN 688 VLS submarines, will be located adjacent to the pressure test tank. With the upper test tank section removed, a simulated hull loading platform can be placed above the hull fairing to duplicate loading and handling operations, in conjunction with actual VLS loading and handling equipment. A sea-state simulator will be available to duplicate actual sea conditions, either in the pressure test tank or under the missile tube hatch alone. A computer will be used to simulate actual tube operating conditions and analyze all pertinent test data received from the fully instrumented system.

ASROC LAUNCHING GROUP LAND-BASED TEST FACILITY



Mock-Up of ASROC Weapon Handling System



Newly Developed Harpoon Interface Panel

The ASROC Launching Group Land-Based Test Facility serves as a land-based test platform for the evaluation of future payload loading and stowage capabilities, the investigation and testing of system improvements, the simulation of fleet problems, and other testing in support of NUSC's role as ASROC launcher design agent and in-service engineering agent. The facility includes the Mk 16 launching group (Mk 112 launcher and Mk 199 launcher captains control panel) completely integrated with an FF 1052 class magazine and weapon handling system, a complete ASROC weapon handling system as installed on a DD 963 class ship, and other special purpose test equipment. The facility has the capability to duplicate actual ASROC and Harpoon weapon loading and handling operations as they occur on DD 963 and FF 1052 class ships.

New Mk 114 Guide for Mk 16 ASROC Launcher

ASROC Launcher with Control Station

COMPUTER FACILITIES

VAX Computer in Building 1246

Computer facilities for the Launcher and Missile Systems Department are located in Building 1246. These systems include the MASSCOMP Data Acquisition/Reduction Facilities, the Engineering Analysis Computational Facilities, and the Computer-Aided Engineering Design System.

MASSCOMP Data Acquisition/Reduction Facilities

The data acquisition facilities, which are located on the first floor of Building 1246, are based on the MASSCOMP 5000 series family of computers. The facility has the ability to record flow phenomena by use of various field sensors and to reproduce the data. The MASSCOMP computer also has a high-speed, high-sampling rate data acquisition system to capture any transients that might occur in the flow system.

MASSCOMP Computer System Provides Data Analysis for All Facilities

The system includes one MASSCOMP 5600 and two MASSCOMP 5500 computer systems. One of the 5500 systems is equipped with an Ethernet controller, allowing communications between the MASSCOMP and the department's VAX computer system. As a result, data can be transferred for further analysis easily and more reliably. To allow graphic and numerical output to be generated for use in reports or presentations, the MASSCOMPs are equipped with various output devices, including color pen plotters, laser printers/plotters, and dot matrix printers. The high-resolution graphics terminals attached to the MASSCOMPs also provide camera-ready quality output.

The MASSCOMP 5000 series of computers features virtual memory, sophisticated program development tools, a wide range of UNIX utilities, and standard networking facilities. These systems are capable of taking data at a rate of 1 million samples/second. The systems are also equipped with digital-to-analog (D/A) and analog-to-digital (A/D) converters. The A/D converter is capable of reading up to 64 A/D channels in random order. The D/A converter features eight channels, each capable of a 500-kHz update rate.

Engineering Analysis Computational Facilities

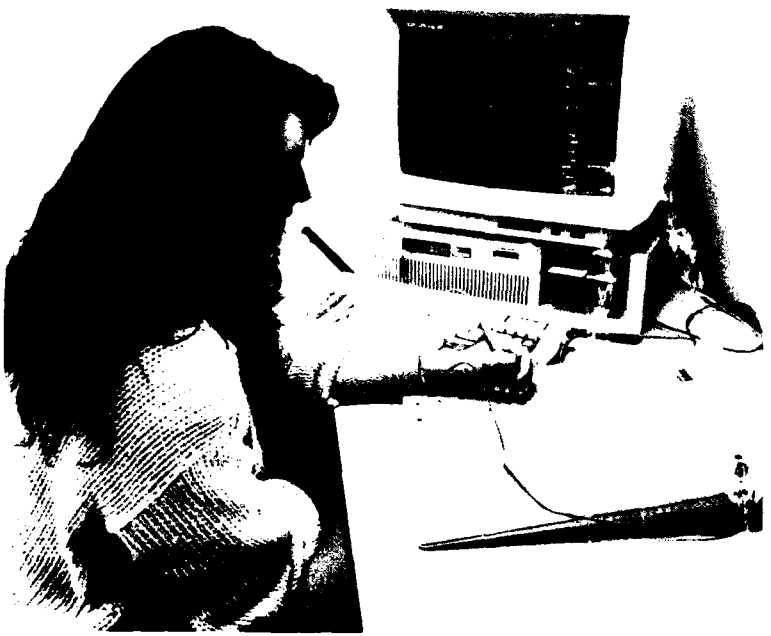
The launcher systems engineering analysis computer resources are located on the second floor of Building 1246. The resources are based on VAX and MicroVAX computers, and several PCs, and an extensive software library is available on these systems. Additional resources are available on NUSCNET, the NUSC local area network. NUSCNET provides access to the Center's Cray XMP supercomputer, several UNIVAC mainframes, and more than 100 VAX and MicroVAX computers at NUSC. NUSCNET can also be used to access ARPANET, MILNET, and other worldwide resources.

A VAX 11/785 computer is the central resource for analysis. This computer supports 60 alphanumeric terminals, 10 graphic terminals, and several text and graphic hardcopy devices. System software includes FORTRAN and BASIC compilers for program development. NASTRAN and ABAQUS finite element analysis codes are used for linear and nonlinear static analysis, normal modes analysis, DDAM shock analysis, and direct transient dynamic analysis. Graphics for finite element model development and postprocessing is performed using the SDRC IDEAS program, which also supports EZGRAF and Plot-10. Dynamic simulations are performed with the underwater vehicle launch dynamics simulation (UVLDS) code, the SEA-DYNE cable simulation code, and with the ACSL and CSMP general-purpose dynamic simulation codes. Potential flow analyses are performed with SIMPLE and XYZ codes. Data base applications are coded using DEC software DATATRIEVE and FMS. WPS/PLUS word processing software is supported for analysis report development. A MicroVAX computer is available for additional computational support and program development.

Several personal computers are available for special-purpose applications including noise transmission modeling, data acquisition, and project management.

The Launcher and Missile Systems Department is currently in the process of acquiring two Silicon Graphics 4D/25 personal IRIS workstations. These units will expand modeling and analysis capabilities for launch dynamics, cable simulations, and finite element analysis. A VAX upgrade and additional PC workstations will also augment current capabilities.

Computer-Aided Engineering Design System

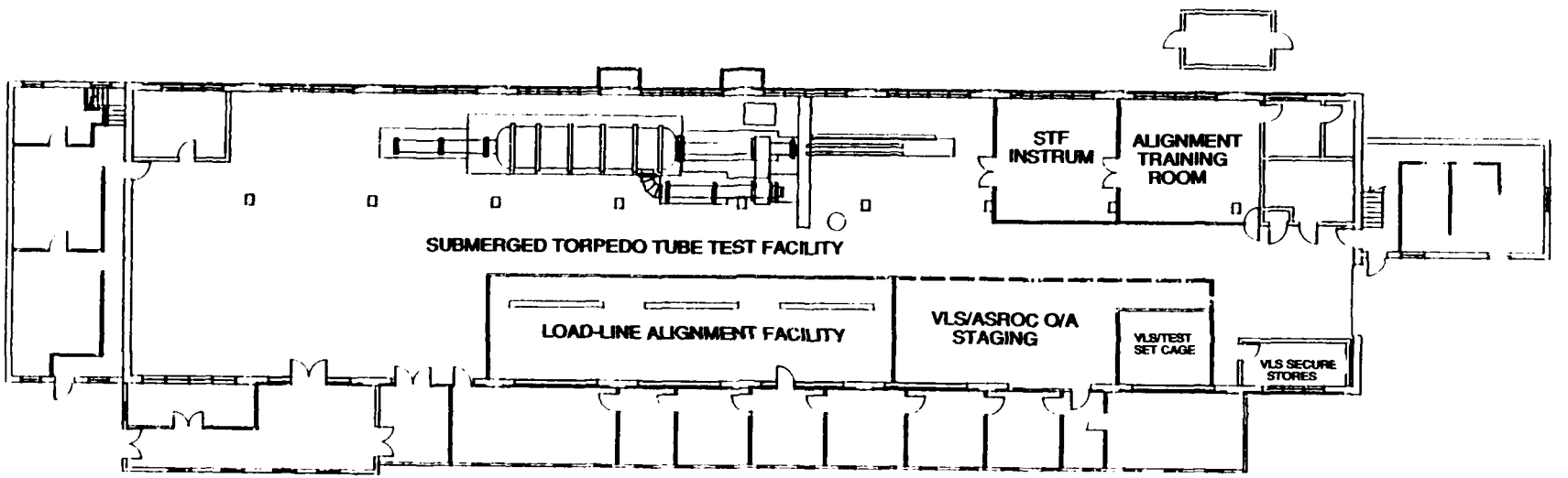


Engineering Design Support Provided by CAD System

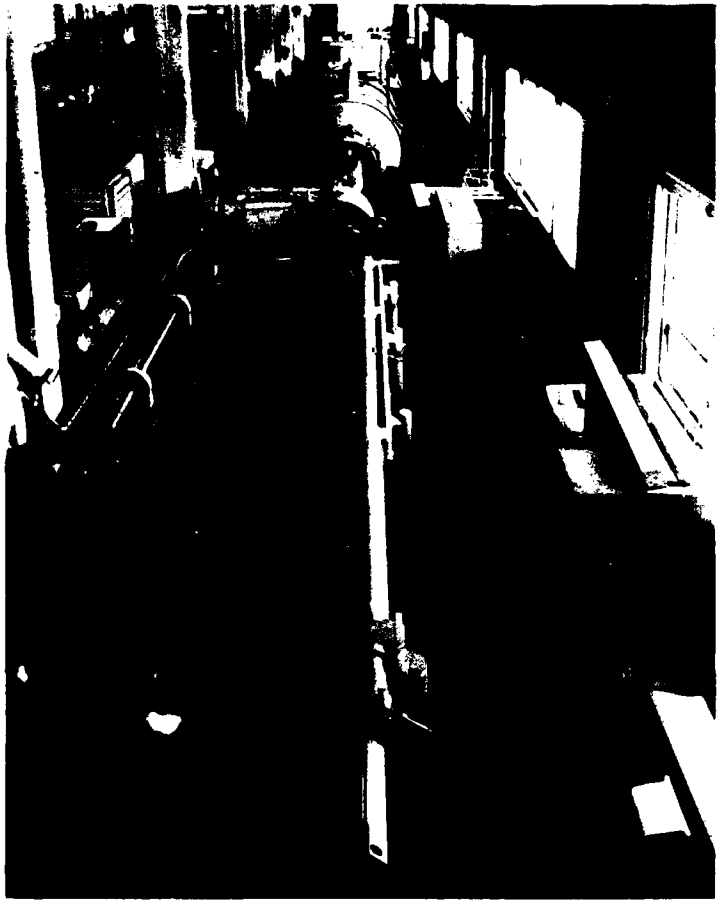
The Launcher and Missile Systems Department supports a computer-aided design (CAD) system based on ComputerVision hardware and software on PC-based systems. This configuration is consistent throughout NUSC, the Naval Sea Systems Command, and several major contractors so that transportability of CAD drawings is widely supported.

CADDS software is supported on six high-end PC-based ComputerVision systems. Output devices produce drawings up to E size. These PC/AT and Intel 386-based systems run a subset of the CADDS 4X software. Drawings may be transferred to the high-end CADDS 4X systems for detailing.

BUILDING 113



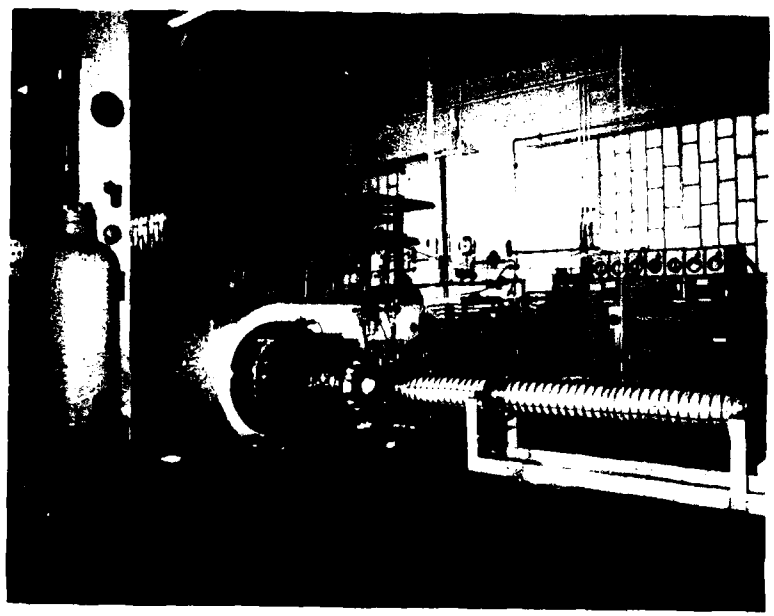
Building 113 Floor Plan



Overview of Mk 54 Submerged Torpedo Tube Test Facility

Building 113 has long been associated with Launcher and Missile Systems Department operations. Although it houses only two facilities at present, many other facilities have been located in the building over the years.

MK 54 SUBMERGED TORPEDO TUBE TEST FACILITY

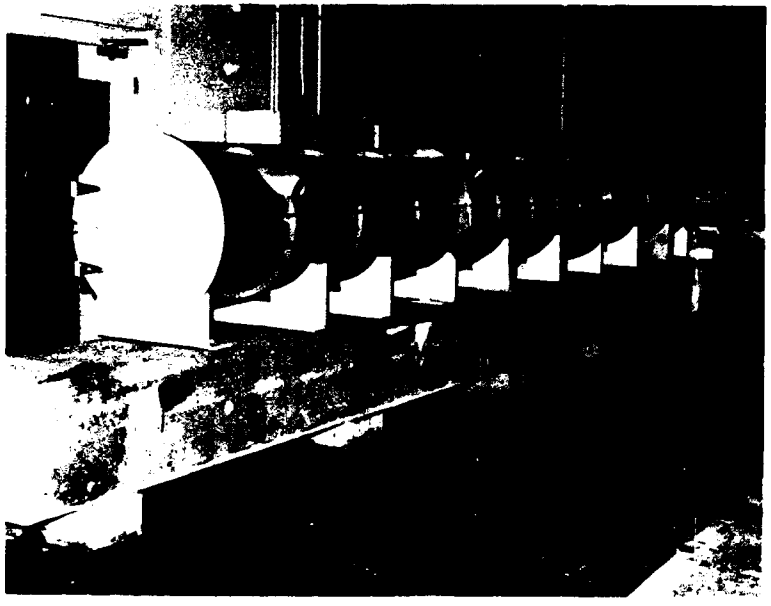


Mk 54 Submerged Torpedo Tube Test Facility with a Turbine Pump Installed

This Building 113 facility is currently scheduled for use as the test platform for developmental turbine pumps until a new facility is incorporated into Building 1246. Thereafter, it is intended to use the facility for any project requiring extensive duration or major configuration changes.

The facility consists of a Mk 54 torpedo tube, modified with hydraulic controls, actuators, and interlocks, attached to a water-filled tank into which a weapon can be fired and then buffered to a stop. The launch motivation is currently supplied by a modified ram pump system (employing stainless steel cylinders and a peripheral dashpot) or any one of the existing or developmental turbine pump systems with an attendant suction pipe. The facility is also equipped with an external power loader for tube loading and unloading and an internal retrieval mechanism to reload the launched vehicle into the tube from the buffer. Typically, the dummy launched is a modified Mk 14 shape weighing approximately 4000 pounds. Simulated launches to a depth of 500 feet are possible.

ALIGNMENT SCHOOL FACILITY



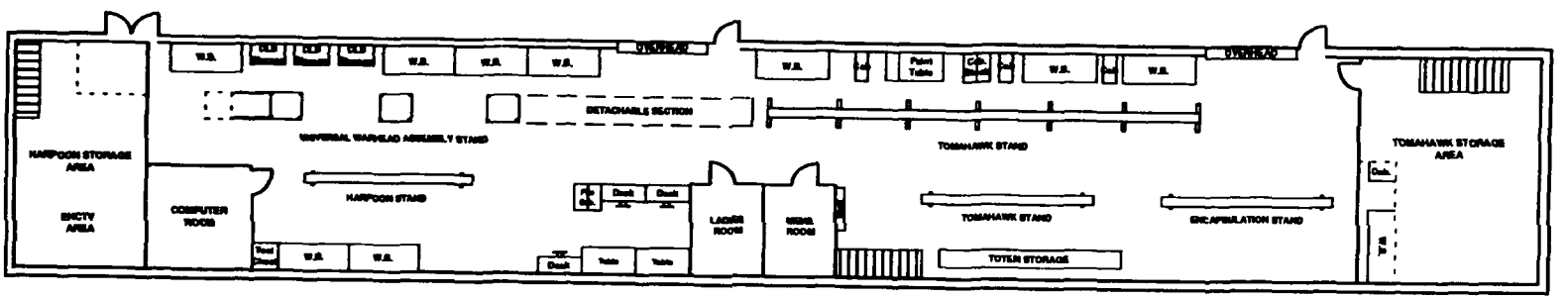
Mock-Up of Torpedo Tube

Another occupant of Building 113, this facility is used to provide hands-on training for submarine torpedo tube optical mapping and load-line alignment. The alignment school is unique in that it is the only facility devoted to this instruction in the entire Navy. The facility, which is used by both Navy and shipyard personnel, consists of a simulated torpedo tube and associated optical instructional devices. It duplicates (or closely simulates) U.S. Navy submarine fleet torpedo tube and weapon loading systems; therefore, it requires an area that is as noise free and vibration free as possible.

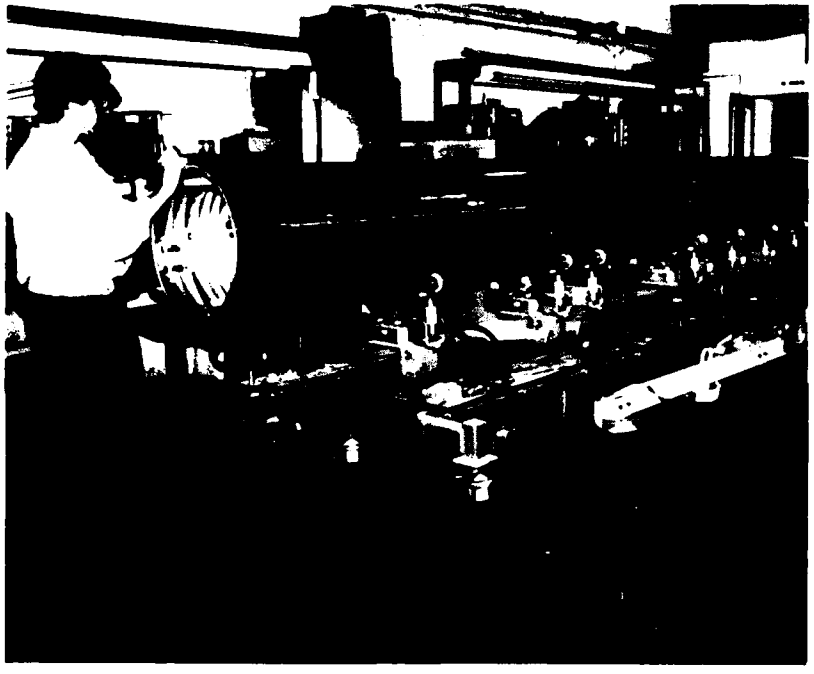
This facility is considered essential to provide shipyard and military personnel with the proper skill level to ensure the effective and accurate alignment of submarine weapon loading systems. This alignment training is essential to support the full training procedures associated with load-line alignment and combat effectiveness of the launcher system.

BUILDING 123

CRUISE MISSILES LABORATORY



Cruise Missile Laboratory Floor Plan

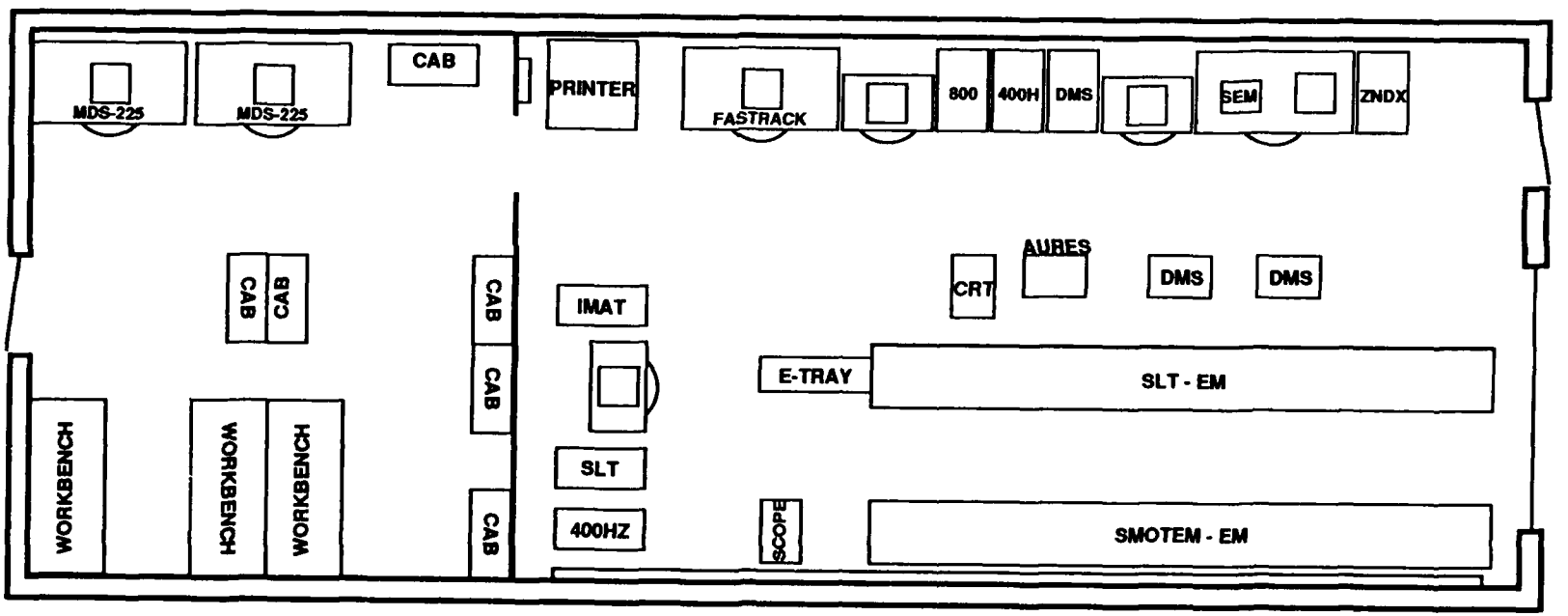


Preparing Instrumentation for Environmental Testing

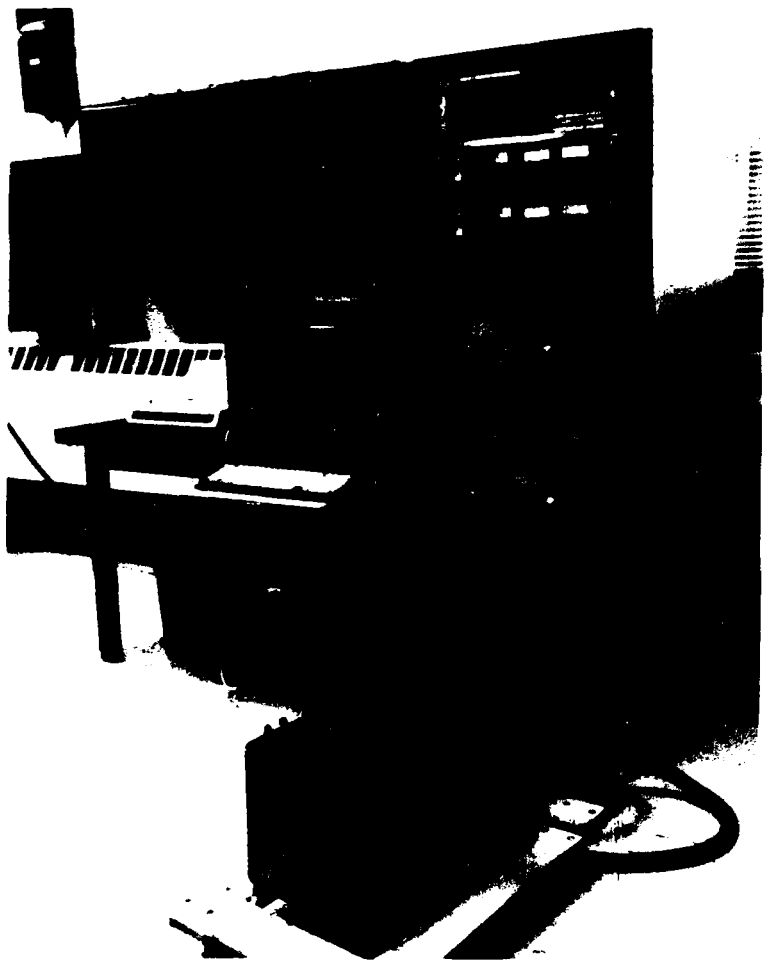
The Cruise Missiles Laboratory is located in Building 123. The facility contains Tomahawk and Harpoon inert vehicle test equipment and cruise missile-peculiar support equipment. In addition, the facility contains logistics support areas for both Tomahawk and Harpoon. The purpose of the facility is to provide the U.S. Navy with factory acceptance testing, design engineering, quality assurance (QA), depot operations, and reliability and maintainability testing for the cruise missiles associated equipment. The facility is used to service five types of inert vehicles, their peculiar support equipment, and various types of capsules. The functions performed in the Cruise Missiles Laboratory vary with each vehicle and capsule. All cruise missile logistic products receive factory acceptance and QA tests prior to acceptance and field use. Foreign military sales (FMS) encapsulated Harpoon equipment is either fabricated and/or acceptance tested prior to delivery to FMS countries. The facility operates as the depot maintenance facility for a variety of trainers, inert shapes, and support equipment and performs all recertifications for cruise missile fitment shapes. Additionally, capsule launching system warheading installation trainers are fabricated in the facility.

BUILDING 109

MISSILE SIMULATOR AND TEST VEHICLE DEVELOPMENT FACILITY



Missile Simulator and Test Vehicle Development Facility Floor Plan

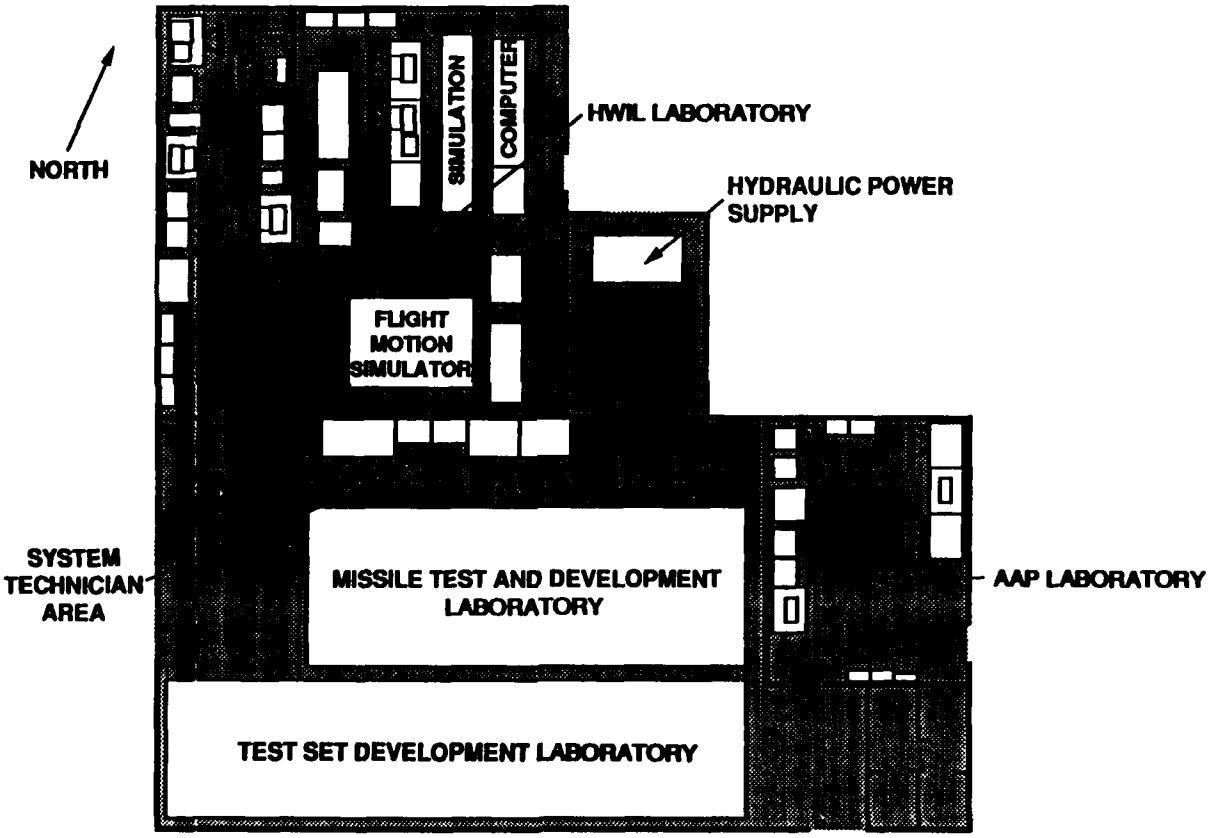


Electronic Simulator Acceptance Tester
Mk 55 Mod 0

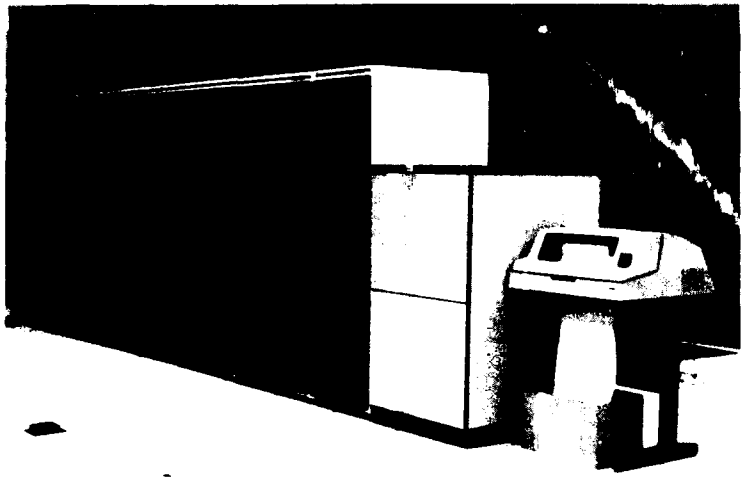
The Missile Simulator and Test Vehicle Development Facility is located in Building 109. The facility fabricates, assembles, tests, and integrates prototype simulators, test vehicles, acceptance testers, and laboratory testers. All software/hardware integration testing and software debugging are performed here. Independent verification of all associated documentation and quality assurance/testing of simulator ORDALTs are accomplished in this facility prior to release to the fleet.

BUILDING 165

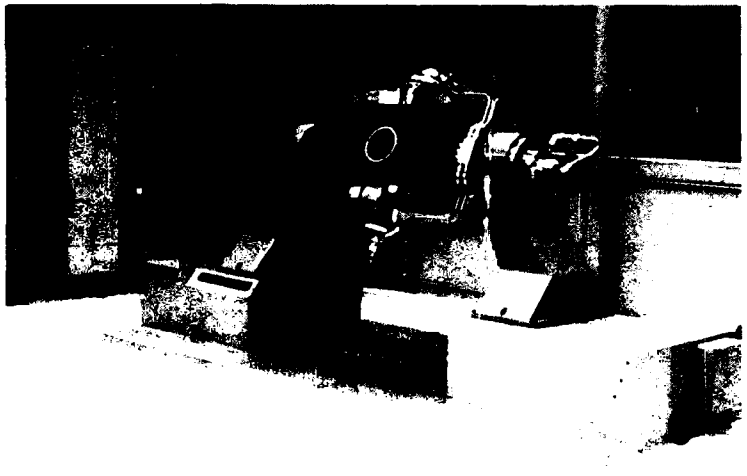
MISSILES DIVISION SIMULATION, DEVELOPMENT, AND TEST FACILITY



Building 165 Floor Plan



HWIL Laboratory Computer System



Newly Installed Test Equipment for HWIL Laboratory

This new facility is located in Building 165. It contains a hardware-in-the-loop (HWIL) laboratory, an autonomous acoustic processor (AAP) laboratory, a test set development laboratory, and a missile test and development laboratory.

The HWIL laboratory comprises avionics hardware, electronics, and software models that provide simulations of the operational environment encountered by a missile in flight. The objective of the HWIL laboratory is to provide to the test engineers realistic environmental conditions and valid missile performance data. This information is obtained by using valid software models, actual missile hardware, and a flight motion simulator.

The AAP laboratory comprises the AAP computer system and algorithms used in the signal processing of sonobuoy data generated and collected during at-sea testing of the AAP. The AAP is designed to process directional sonobuoy data and provide continuous calculations of bearings to localize and track a target of interest. The objective of the AAP laboratory is to provide a test facility for evaluating AAP performance using at-sea test data in an effort to develop a signal processing capability for an autonomous antisubmarine warfare search system.

The test set development laboratory comprises the various equipment used to check out and develop the current and future cruise missile test set equipment.

The purpose of the missile test and development laboratory is to analyze development efforts and check out prototype hardware and mock-ups of future underwater missile systems, e.g., the remote broach/ launch-and-leave missile and the high-speed underwater missile.